

ABSTRACT OF THE DISCLOSURE

A stable field-emission electron source that does not suffer from a current drop even after a high-current density operation for a long time is provided. The
5 field-emission electron source includes: a substrate; an insulating layer that is formed on the substrate and that has a plurality of openings; cathodes arranged at the respective openings in order to emit electron beams; a lead electrode formed on the insulating layer in order to control emission of electrons from the respective cathodes; and a surface-modifying layer formed on the surface of each of the
10 cathodes emitting electrons, comprising a chemical bond between a cathode material composing the cathodes and a material different from the cathode material.